Pemilihan Lokasi Mini CNG Plant dengan Metode ANP *(Analitycal Network Proses)* serta Optimasi Rantai Pasok CNG ke Bali, Nusa Tenggara Barat, dan Nusa Tenggara Timur.

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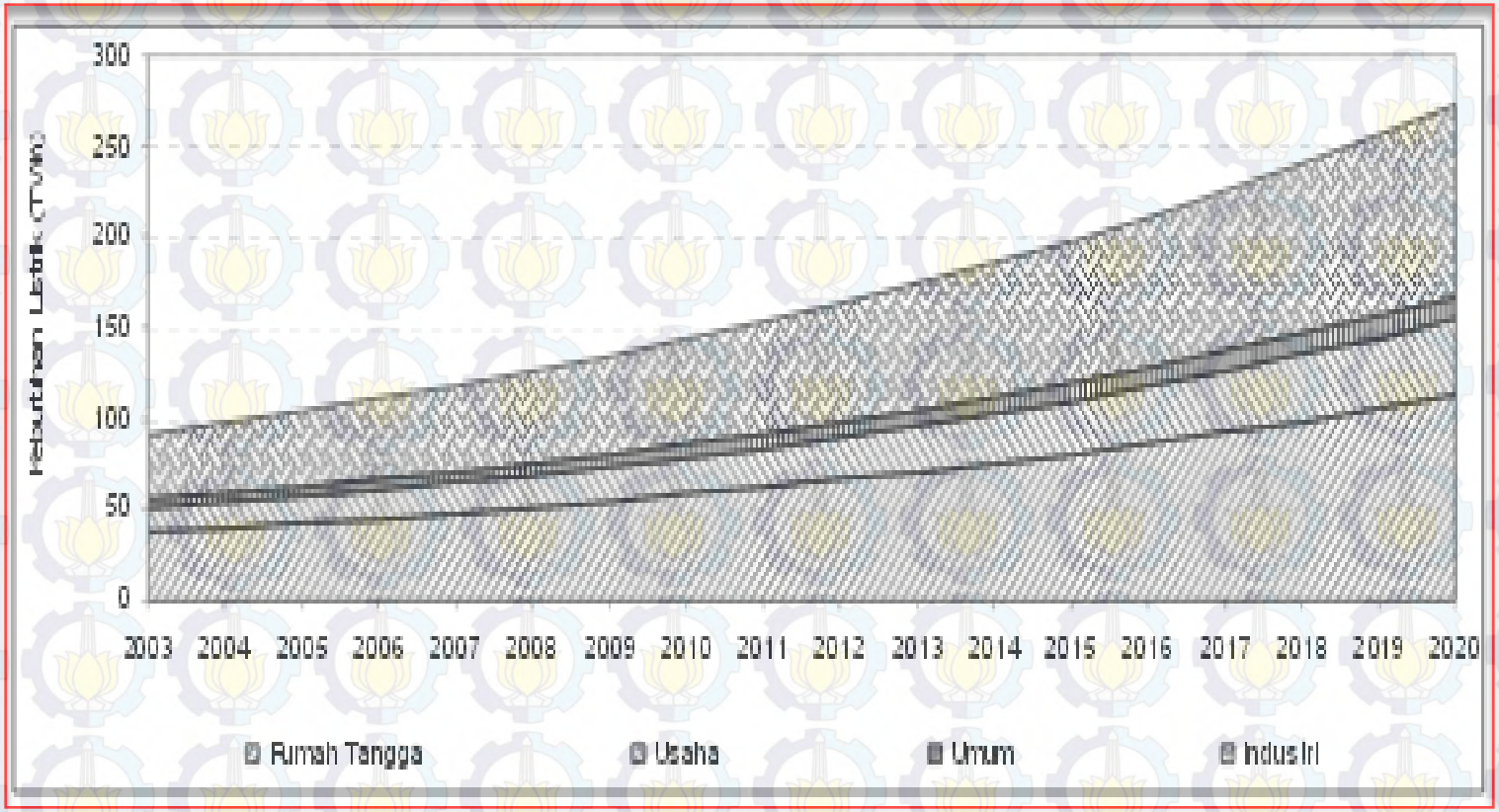
Proyeksi Kebutuhan Listrik Hingga 2020



Sumber : PLN

Produksi Minyak Bumi Hingga 2012

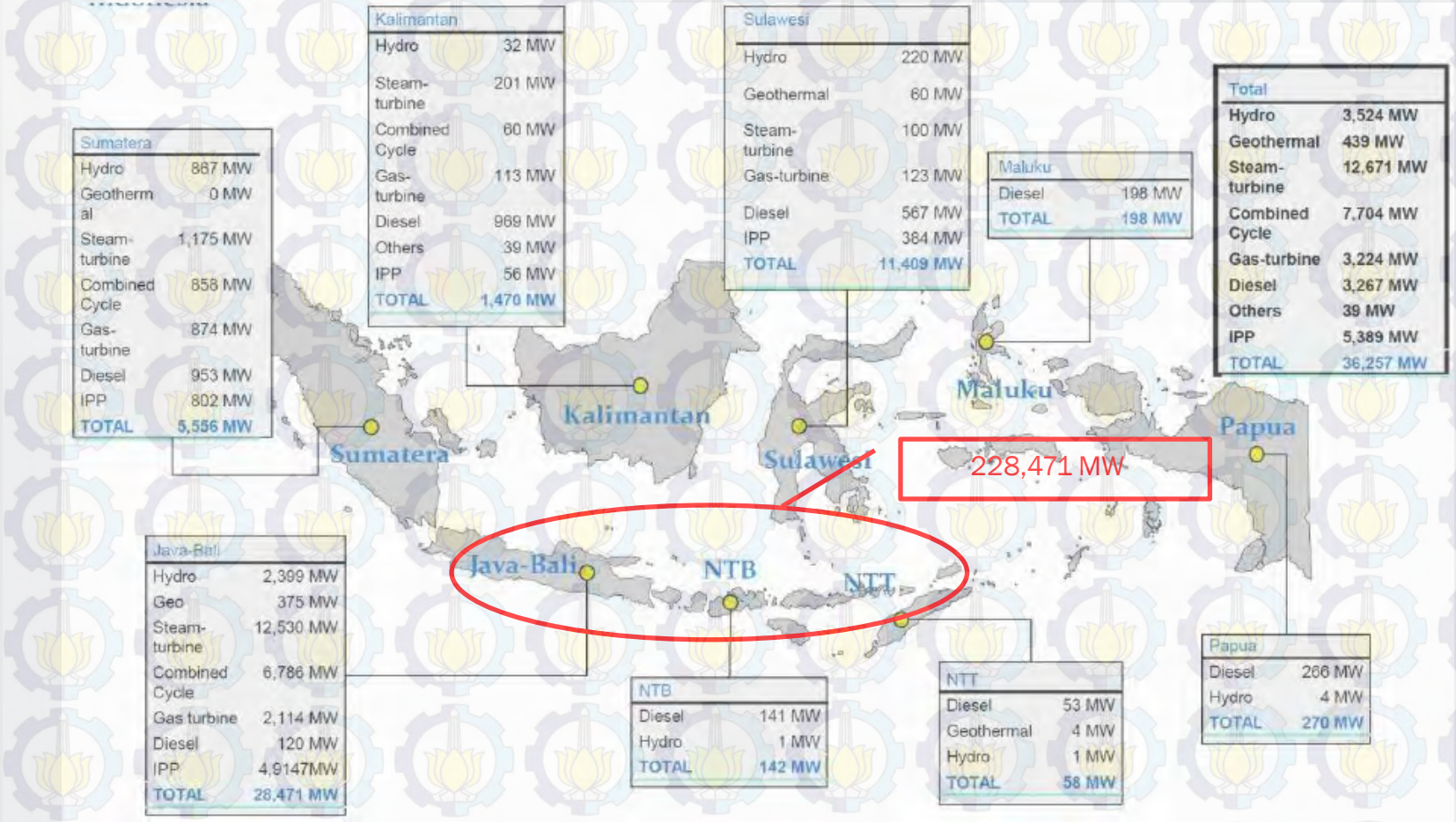
PRODUKSI MINYAK BUMI

Ribu Barel

TAHUN	MINYAK BUMI	KONDENSAT	JUMLAH
2004	353.945	46.541	400.486
2005	341.203	46.450	387.654
2006	322.350	44.699	367.050
2007	305.137	43.211	348.348
2008	312.484	45.016	357.500
2009	301.663	44.650	346.313
2010	300.872	43.965	344.836
2011	289.899	39.350	329.249
2012*	143.654	19.979	163.633

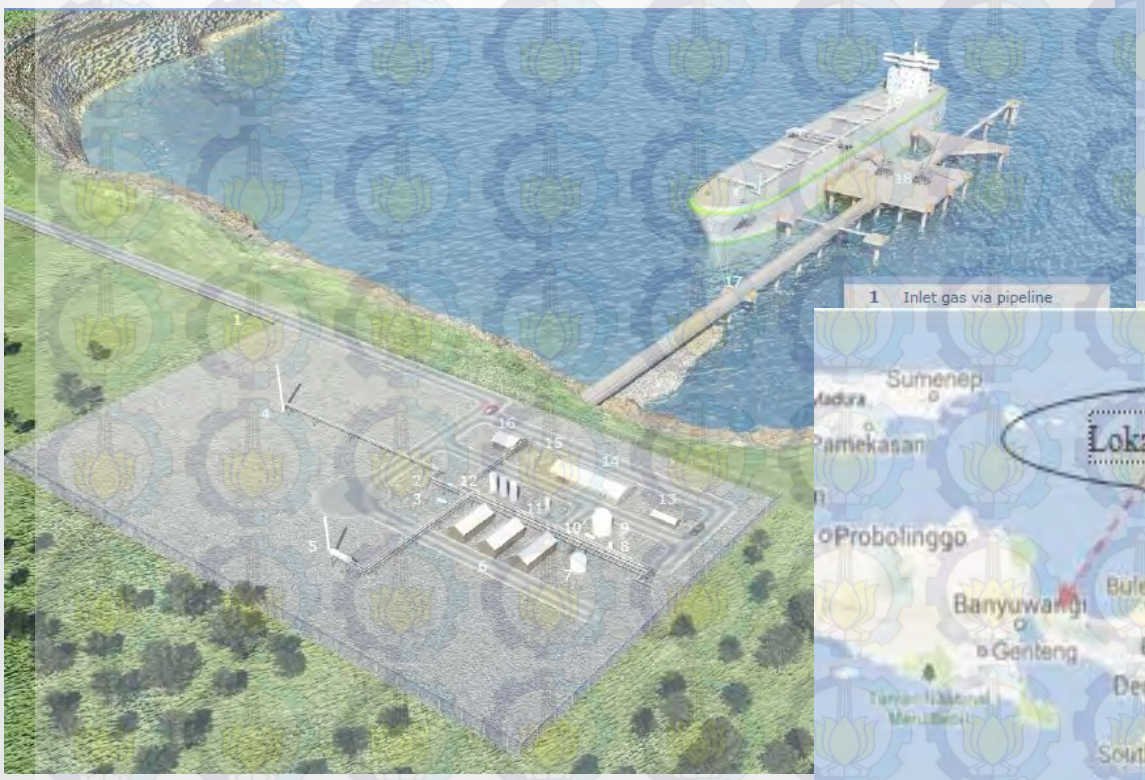
Sumber : Ditjen MIGAS, diolah Pusdatin
Keterangan:
* Data Semester 1 2012
MBOPD = Ribu Barel per Day

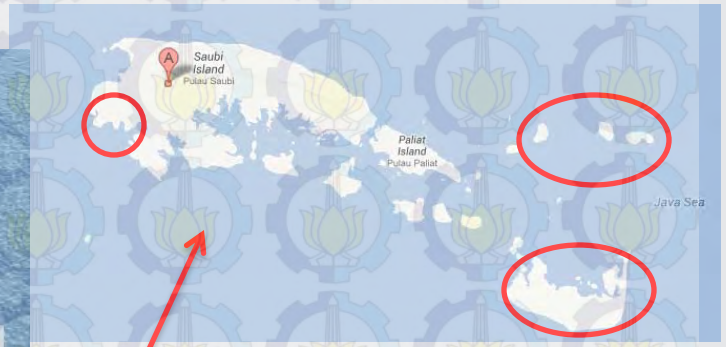
Potensi Kebutuhan Gas Indonesia



Sumber : PJB 2012

Letak Sumber gas ke demand





Sumber : https://maps.google.com/

Rumusan Masalah

1. Bagaimana cara memilih lokasi CNG Plant di Kepulauan Kangean dengan metode ANP *(Analytical Network Process)* ?
2. Bagaimana desain model pendistribusian CNG yang optimal, meliputi kapasitas kapal CNG , jenis kapal CNG, serta kapasitas pada terminal pengirim?
3. Bagaimana analisa biaya modal (*capital cost*) pembangunan terminal CNG dan proses distribusi CNG dari lokasi terpilih ke Bali, NTB, dan NTT.?

Tujuan Penelitian

1. Mendapatkan lokasi CNG Plant di 4 alternatif lokasi yang terpilih yaitu di Pulau kangean, Pulau Raas, Pulau Sapudi dan Pulau Talango
2. Merancang sistem distribusi Gas yang optimal dari CNG Plant di lokasi yang terpilih ke konsumen
3. Mendapatkan analisa biaya modal (*capital cost*) pembangunan terminal CNG dan proses distribusi CNG dari lokasi terpilih ke Bali, NTB, dan NTT.

Batasan Masalah

1. Penentuan pemilihan lokasi CNG Plant di Kepulauan Kangean hanya di empat lokasi yaitu Pulau kangean, Pulau Raas, Pulau Sapudi dan Pulau Talango
2. Jumlah gas yang akan di suplai sebesar 82 mmscfd.
3. Pendistribusian gas ke daerah Bali, NTB, dan NTT.

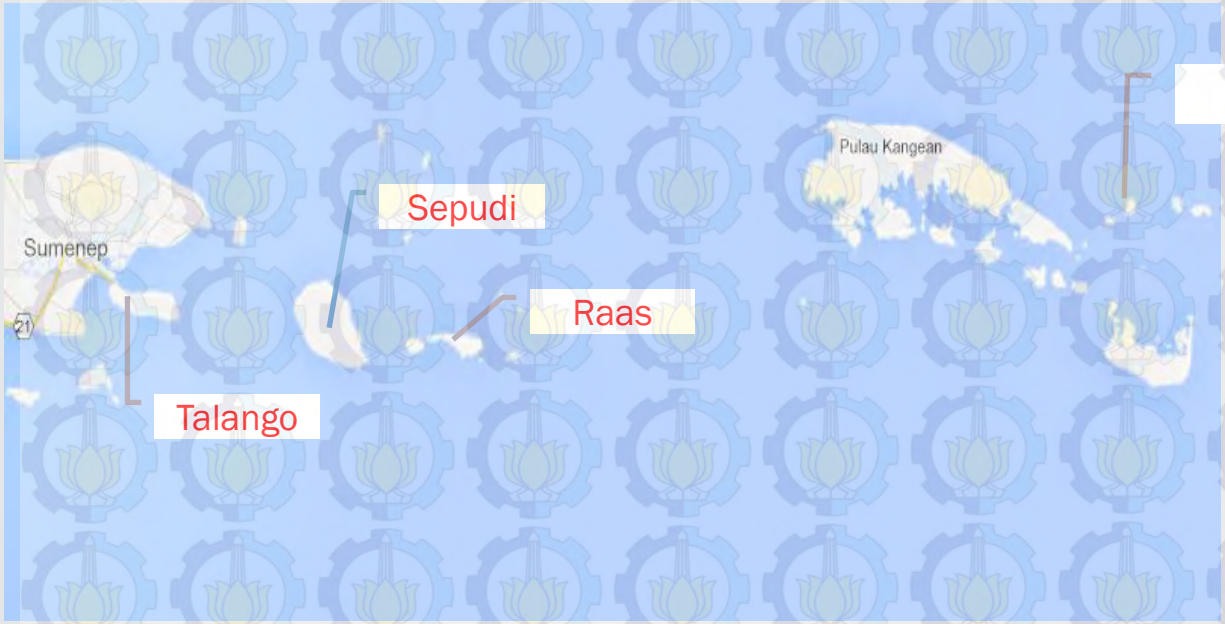
Ruang Lingkup Pekerjaan

- Pemilihan Lokasi
- Optimasi rantai pasok CNG
- Capital Invesment

Bagian 1

Pemilihan Lokasi dengan metode ANP
(Analytical Network Process)

Alternatif Lokasi



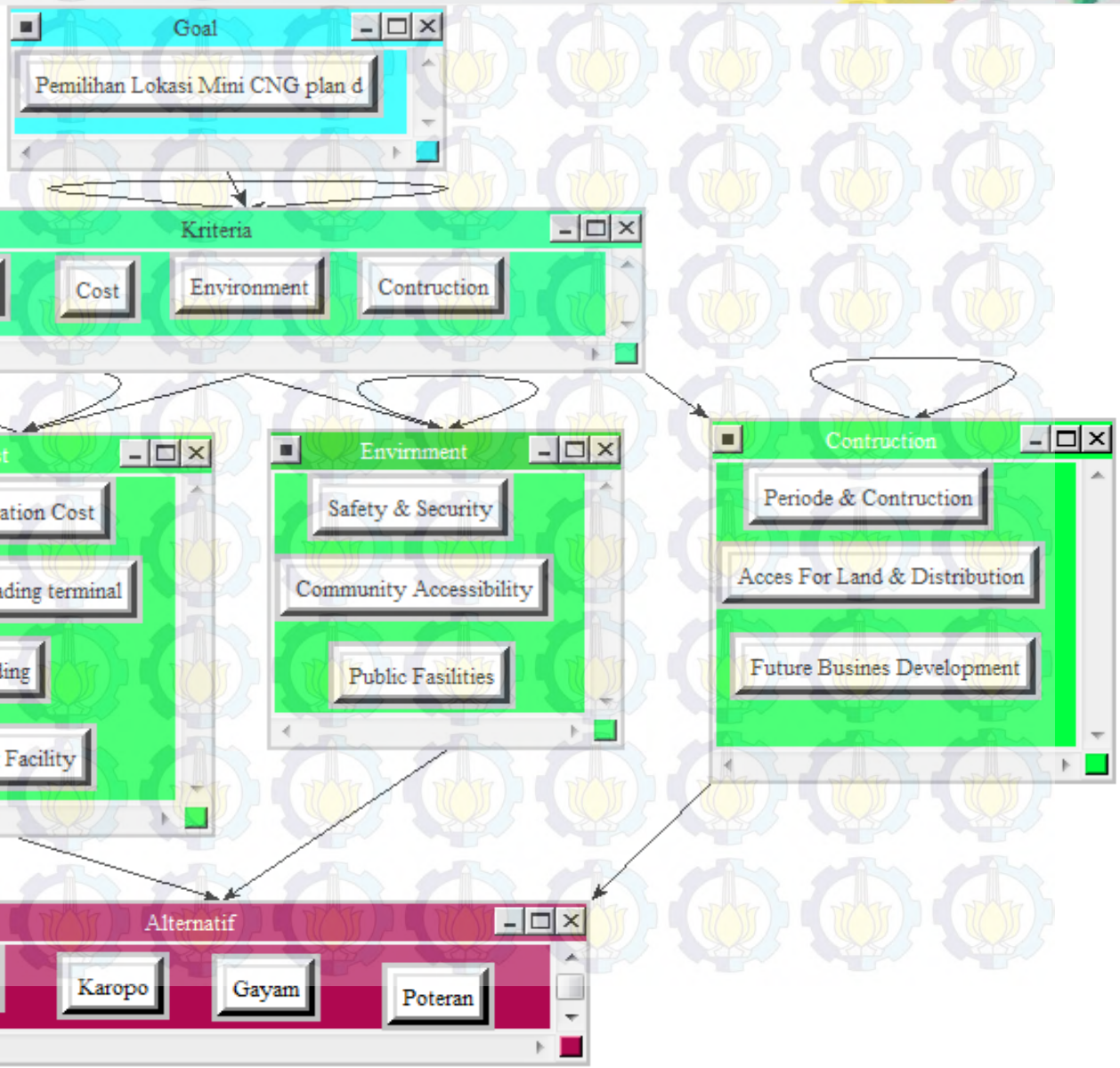
- ✓Ds. Pagerungan (Kangean)
- ✓ Ds. Gayam (Sepudi)
- ✓ Ds. Karopo (Raas)
- ✓ Ds. Poteran (Talango)

Menggunakan Metode ANP (Analitycal Network Process)

Penentuan Kriteria dan subkriteria

1	Water Front (C1)	Sustainabilyty for Acces (SC-01)
		Water Deep (SC-02)
		Tide (SC-03)
		Wave (SC-04)
2	Cost (C2)	land & preparation cost (SC-05)
		Pipe Line to Loading Terminal (SC-06)
		Berthing Facility (SC-07)
		Dredging (SC-08)
3	Environment (C3)	Safety & Security (SC-09)
		Community Accessibility (SC-10)
		Public Facilities (SC-11)
4	Contructio n (C4)	Periode & Contruction (SC-12)
		Acces For Land & Distribution (SC-13)
		Future Busines Development (SC-14)

Pemodelan ANP dengan Super Decision



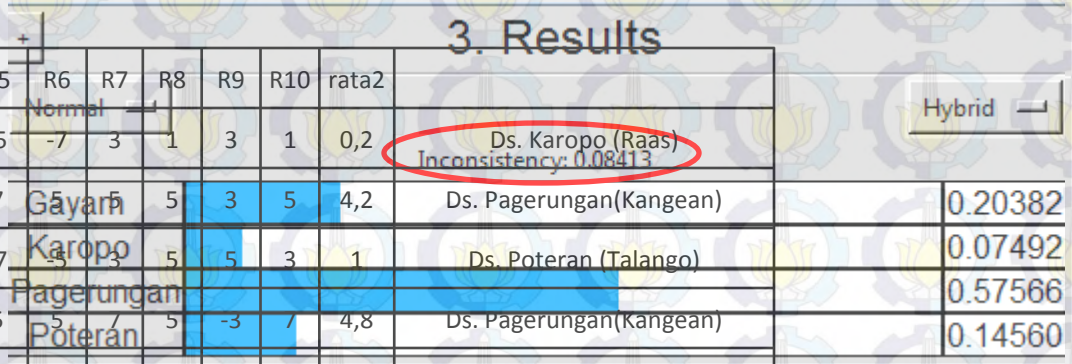
Pengolahan Data

Pengambilan data dengan kusioner

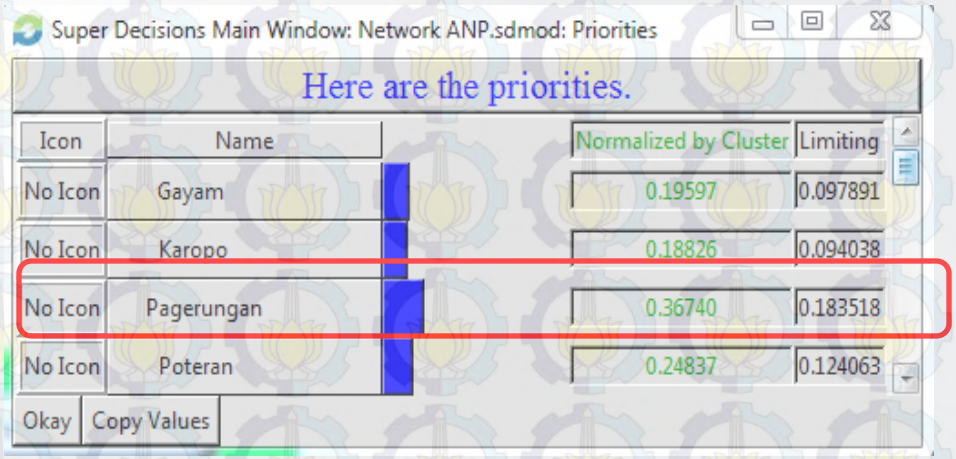
perekapan kuisioner

Pengolahan dengan Software

	R 1	R2	R3	R4	R5	R6	R7	R8	R9	R10	rata2	
Ds. Gayam (Sepudi)	3	5	-5	3	-5	-7	3	1	3	1	0,2	Ds. Karopo (Raas)
Ds. Gayam (Sepudi)	5	5	-3	5	7	5	5	5	3	5	4,2	Ds. Pagerungan(Kangean)
Ds. Gayam (Sepudi)	3	-5	5	3	-7	-5	3	5	5	3	1	Ds. Poteran (Talango)
Ds. Karopo (Raas)	7	5	3	7	5	5	7	5	-3	7	4,8	Ds. Pagerungan(Kangean)
Ds. Karopo (Raas)	-3	-5	7	-5	-5	-5	-5	3	3	-3	-1,8	Ds. Poteran (Talango)
Ds. Pagerungan(Kangean)	-7	-7	-7	-7	-5	5	-7	-7	5	-7	-4,4	Ds. Poteran (Talango)



Hasil

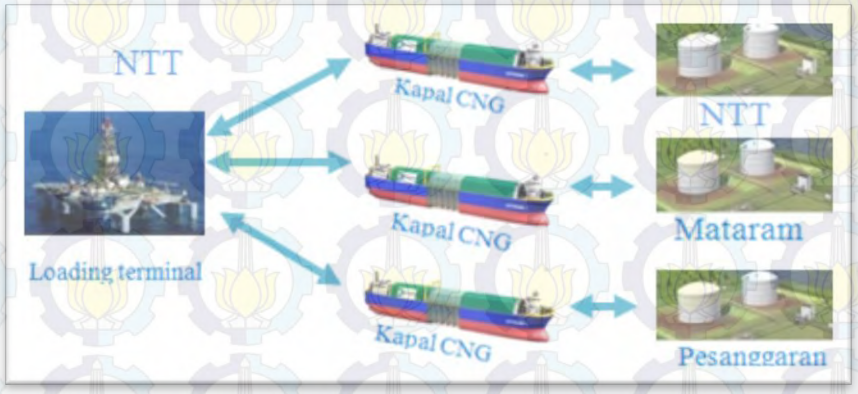


Alternatif	nilai limit	Ranking
Ds. Pagerungan	0,183518	1
Ds. Poteran	0,124063	2
Ds. Gayam	0,097891	3
Ds. Karopo	0,094038	4

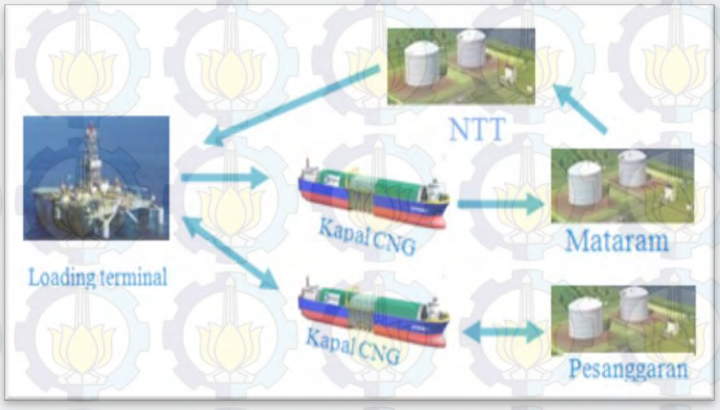
Bagian 2

Optimasi Supply Chain

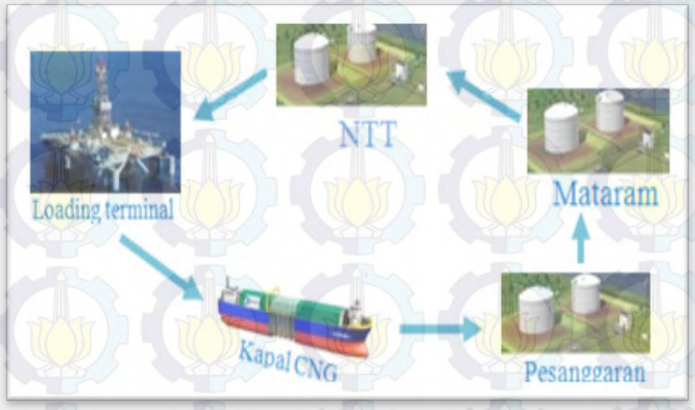
Alternatif Model Alur pelayaran



Model 1



Model 2



Model 3

Input data kapal

SHIP DATA		
SHIP ZIZE		
Coselle C16		
LPP	136,5	Meter
B	23	
H	9	
T	7	
Coselle C20		
LPP	136,5	Meter
B	23,5	
H	9,45	
T	8	
Coselle C25		
LPP	155,6	Meter
B	23,5	
H	9,45	
T	8	
Coselle C30		
LPP	158	Meter
B	28	
H	9,45	
T	8	

CNG Capacity (ton)		
Coselle C16	1288,30	Ton
Coselle C20	1585,60	
Coselle C25	1982,00	
Coselle C30	2378,40	
CNG Capacity (m3)		
Ship Loading/Unloading data		
Coselle C16	12	Hour
Coselle C20	12	
Coselle C25	12	
Coselle C30	12	
Ship Speed		
Coselle C16	13	Knot
Coselle C20	13	
Coselle C25	14	
Coselle C30	14	

Input data

Ship crew		
Coselle C16	19	person
Coselle C20	19	
Coselle C25	19	
Coselle C30	19	
Ship main engine Power		
Coselle C16	2594,92	kw
Coselle C20	2606,76	
Coselle C25	2531,01	
Coselle C30	4180,87	
Ship main engine MFO		
Coselle C16	17,41	ton/day
Coselle C20	17,49	
Coselle C25	16,98	
Coselle C30	28,05	
Ship main engine MDO		
Coselle C16	2,61	ton/day
Coselle C20	2,62	
Coselle C25	2,55	
Coselle C30	4,21	

MFO & MDO Price		
MFO Price	611	US$/Ton
MDO	904	
Voyage Data		
annual Docking	20	Day
emergency miantenance	15	
distance trip		
pagerungan-Bali	123,11	Nmiles
Pagerungan-NTB	204,09	

Input data

Production Capacity		
	100MMSCFD	
DEMAN CAPACITY		
Bali		
	372	MW
	53,14285714	MMSCFD
	384451,3714	TPY
	1053,291429	TPD
NTB & NTT		
	200	MW
	28,57142857	MMSCFD
	206694,2857	TPY
	566,2857143	TPD
Economic Data		
Averange crew cost	26847,00	US$/mont
insurance cost	5,00	US$/Ton
loan payment method	20	year
unit port charge	5,5	US$/Ton
Konversi satuan		
100 MMSCFD	700	MW
100 MMSCFD	1982	TPD
1 MMSCF	19,82	ton
1 MMSCFD	1000	mmbtu

Constraint dan luaran

Constraint				
SHIP CARRYING	Min Value	g(x)	max value	unit
Ship Carrying Capacyty Bali	384451,37	384508	768902,7429	Ton/year
Ship Carrying Capacyty NTB & NTT	206694,29	206920,8	413388,5714	Ton/year
Round Trip Day	Min Value	g(x)	max value	unit
Ship Round Trip Day To Bali	0	2869,952857	7800	jam
Ship Round Trip Day To NTB & NTT	0	3580,547143	7800	jam

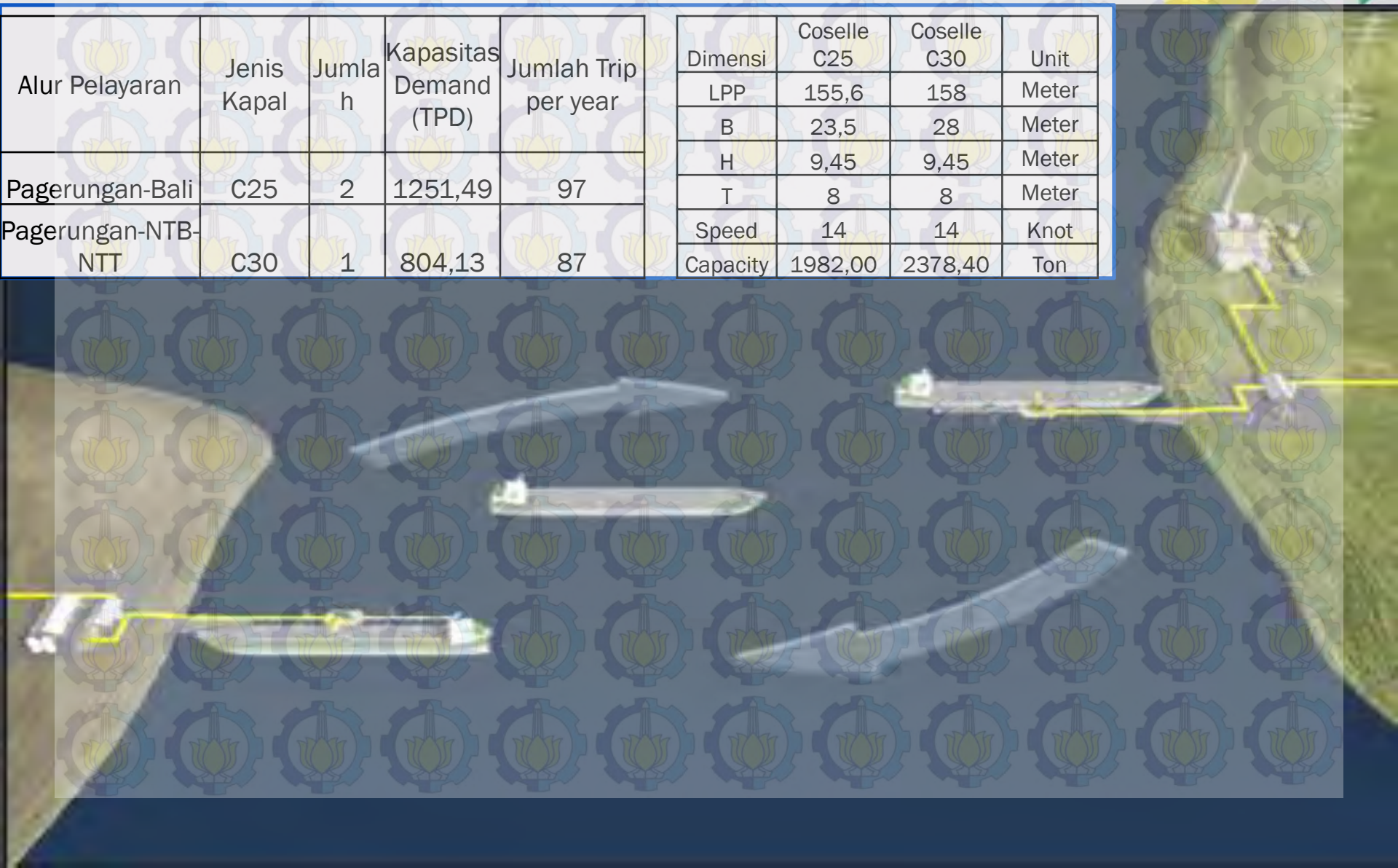
Output				
Bali	Min Value	g(x)	max value	unit
Coselle C16	0	0	100	unit
Coselle C20	0	0	100	unit
Coselle C25	0	2	100	unit
Coselle C30	0	0	100	unit
NTB-NTT	Min Value	g(x)	max value	unit
Coselle C16	0	0	100	unit
Coselle C20	0	0	100	unit
Coselle C25	0	0	100	unit
Coselle C30	0	1	100	unit

Round Trip				
Bali	Min Value	g(x)	max value	unit
Coselle C16	0	0	100	time/year
Coselle C20	0	0	100	time/year
Coselle C25	0	97	100	time/year
Coselle C30	0	0	100	time/year
NTB-NTT	Min Value	g(x)	max value	unit
Coselle C16	0	0	100	time/year
Coselle C20	0	0	100	time/year
Coselle C25	0	0	100	time/year
Coselle C30	0	87	100	time/year

Hasil

Alur Pelayaran	Jenis Kapal	Jumlah	Kapasitas Demand (TPD)	Jumlah Trip per year
Pagerungan-Bali	C25	2	1251,49	97
Pagerungan-NTB-NTT	C30	1	804,13	87

Dimensi	Coselle C25	Coselle C30	Unit
LPP	155,6	158	Meter
B	23,5	28	Meter
H	9,45	9,45	Meter
T	8	8	Meter
Speed	14	14	Knot
Capacity	1982,00	2378,40	Ton



Bagian 3

Capital Investment

CAPEX

INVESTATION	Unit	Value
Mini CNG Plant (including storage tank)	US$	100.000.000
Unloading terminaL (jetty facilities)	US$	90.000.000
CNG Coselle	US$	902.100.000
Compressor facilities	US$	3.240.000
TOTAL INVESTASI	US$	1.101.346.195

OPEX

OPERATIONAL	unit	Value
Operasional Kapal		
MFO cost per year	US$-year	1.490.804
LO cost per year	US$-year	330.856
Ship crew cost per year	US$-year	387.998
Port charges	US$-year	16.205.739
Insurance Cost	US$-year	84.669
Total Ship Operating Cost	US$/year	18.500.067
Operasional Plant		
Power Requirement at Loading terminal	KW	1.007
Power Requirement at receiving terminal	KW	3.021
Total power requirement	KW	4.028
Electricity rate	US$/KWH	0,77
Annual electricity cost	US$/year	27.169.666
Annual maintenance cost	US$/year	5.506.731
Crew Cost	US$/year	387.998
Total Operational Cost Plant	US$/year	33.064.394
Total oprasional		51.564.461

Revenue

Revenue	unit	Value
Amount of processed gas	mmscfd	82
Amount of processed gas	Bbtud	95
Amount of processed gas	mmbtud	95.204
Amount of processed gas	mmbtu-year	34.749.387

		SKENARIO 1 margin jual US$ 4,00	SKENARIO 2 margin jual US$ 4,25
Feed gas price	US$	7,00	7,00
Processing-CNG-transportation cost	US$	4,00	4,00
margin	US$	**4,00**	**4,25**
Selling price to power plant	US$	**15,00**	**15,25**
Annual revenue	US$	138.997.548,00	147.684.894,75

		SKENARIO 3 margin jual US$ 4.50	SKENARIO 4 margin jual US$ 4.75
Feed gas price	US$	7,00	7,00
Processing-CNG-transportation cost	US$	4,00	4,00
margin	US$	**4,50**	**4,75**
Selling price to power plant	US$	**15,50**	**15,75**
Annual revenue	US$	156.372.241,50	165.059.588,25

Revenue

		Units	Value
CAPEX (Capital Expenditure)	Total Investation Cost	US$	1.101.346.195
OPEX (Operational Expenditure)	Total Operational Cost	US$/year	33.064.394
	Tax	%/year	35
	Depresiation	US$/year	55.067.310
Revenue	Annual Revenue	US$	165.059.588
Inflation		%	5%

No.	Year	CAPEX	Revenue	Operational Cost	Interest	Depreciation	Earning Before Tax	Tax
1	2014	$220.269.239			$50.661.925			
2	2015				$49.247.267			
3	2016		$165.059.588	$33.064.394	$47.751.266	$27.533.655	$56.710.273	$19.848.596
4	2017		$168.360.780	$33.725.682	$46.169.245	$55.067.310	$33.398.544	$11.689.490
5	2018		$168.360.780	$34.400.196	$44.496.257	$55.067.310	$34.397.017	$12.038.956
6	2019		$168.360.780	$35.088.200	$42.727.073	$55.067.310	$35.478.197	$12.417.369
7	2020		$168.360.780	$35.789.964	$40.856.161	$55.067.310	$36.647.346	$12.826.571
8	2021		$168.360.780	$36.505.763	$38.877.671	$55.067.310	$37.910.036	$13.268.513
9	2022		$168.360.780	$37.235.878	$36.785.419	$55.067.310	$39.272.173	$13.745.261
10	2023		$168.360.780	$37.980.596	$34.572.861	$55.067.310	$40.740.013	$14.259.005
11	2024		$168.360.780	$38.740.208	$32.233.082	$55.067.310	$42.320.181	$14.812.063
12	2025		$168.360.780	$39.515.012	$29.758.765	$55.067.310	$44.019.693	$15.406.893
13	2026		$168.360.780	$40.305.312	$27.142.175	$55.067.310	$45.845.983	$16.046.094
14	2027		$168.360.780	$41.111.418	$24.375.132	$55.067.310	$47.806.920	$16.732.422
15	2028		$168.360.780	$41.933.647	$21.448.983	$55.067.310	$49.910.841	$17.468.794
16	2029		$168.360.780	$42.772.320	$18.354.580	$55.067.310	$52.166.570	$18.258.300
17	2030		$168.360.780	$43.627.766	$15.082.250	$55.067.310	$54.583.454	$19.104.209
18	2031		$168.360.780	$44.500.321	$11.621.760	$55.067.310	$57.171.389	$20.009.986
19	2032		$168.360.780	$45.390.328	$7.962.293	$55.067.310	$59.940.850	$20.979.297
20	2033		$168.360.780	$46.298.134	$4.092.406	$55.067.310	$62.902.930	$22.016.026
21	2034		$168.360.780	$47.224.097	$0	$55.067.310	$66.069.373	$23.124.281
22	2035		$168.360.780	$48.168.579	$0	$55.067.310	$65.124.891	$22.793.712
23	2036		$168.360.780	$48.168.579	$0	$27.533.655	$92.658.546	$32.430.491

Result

	Margin					
	4.00	4.25	4.50	4.75	5.00	5.50
Pay Back Period (Year)	20 th	16 th	12 th	11 th	9 th	8 th
IRR (%)	6,82	9,01	11,07	13,02	14,87	18,37
NPV (Million USS)	52	118,9	185,79	252,67	319,557	453,323
PI (Index)	1,2	1,46	1,72	1,98	2,24	2,47

Kesimpulan

Kesimpulan

1. Dalam pemilihan lokasi pembangunan mini CNG plant, maka lokasi yang paling optimal berdasarkan perhitungan dengan menggunakan software *super desicion* adalah di Ds. Pagerungan kecamatan Sapeken kepulauan kangean Sumenep.
2. Dalam pendistribusian CNG dari terminal gas Pagerungan ke tiga lokasi yang akan disuplai yaitu Celukan Bawang (Bali), Nusa Tenggara Barat, dan Nusa Tenggara Timur, model distribusi yang efektif dengan total cost yang paling minimum adalam model 2, dengan uraian sebagai berikut

- ❖ Pelayaran Dari Pgerungan-Bali menggunakan kapal Cosele C25 sebanyak 2 unit dengan 97 Round trip per tahun
- ❖ Pelayaran Pagerungan-NTB-NTT menggunakan kapal jenis C30 sebanyak 1 unit dengan 87 kali round trip per tahun

3. Total biaya transportasi yang dibutuhkan untuk 1 tahun pada model 2 didapatkan sebesar $ 247.210.482,78 . untuk dapat mengembalikan modeal, maka minimal margin penjualan gas sebesar UDS 4,25 per mmbtu.

TERIMAKASIH